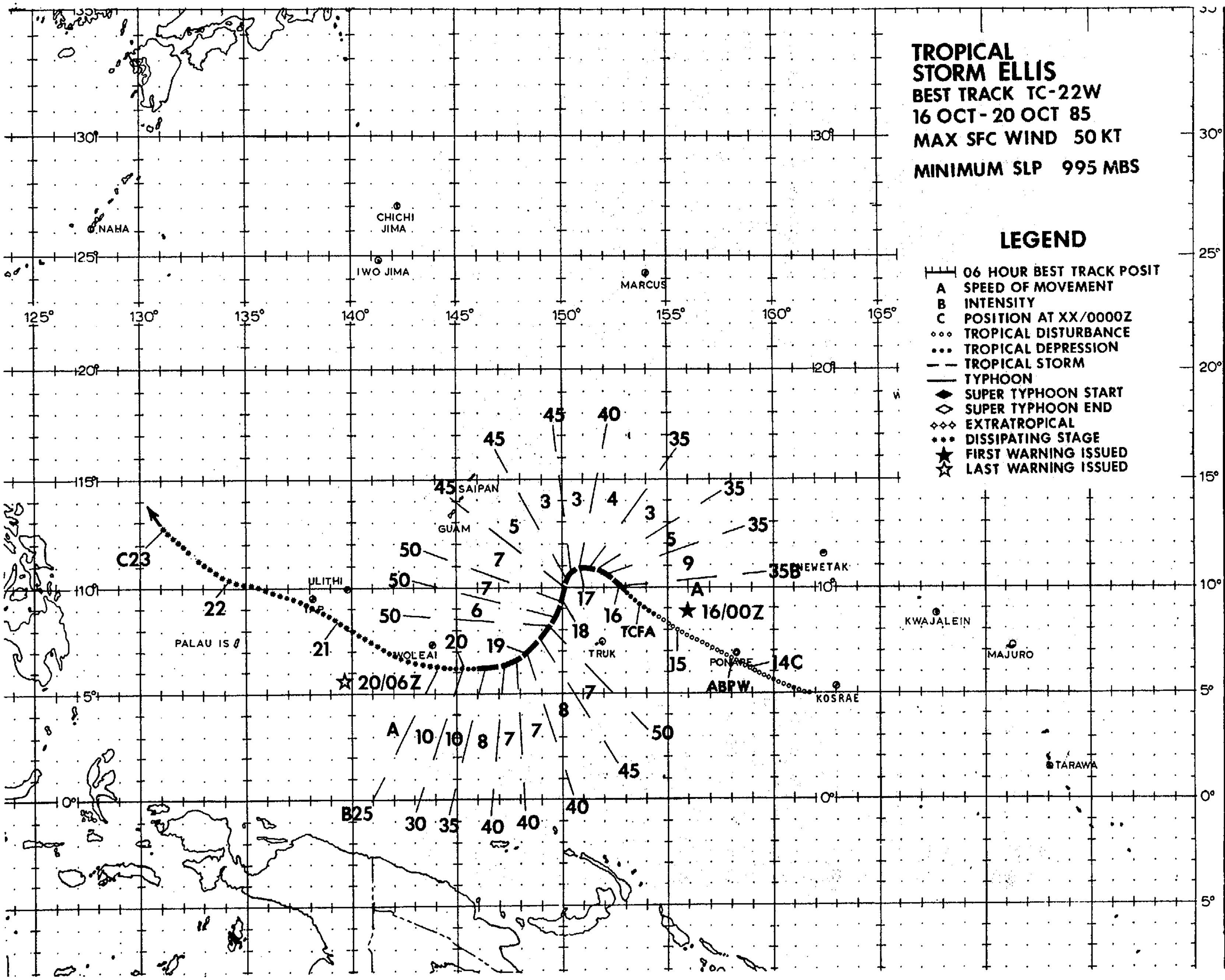
TROPICAL
STORM ELLIS
BEST TRACK TC-22W
16 OCT - 20 OCT 85
MAX SFC WIND 50 KT
MINIMUM SLP 995 MBS
LEGEND
06 HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
DISSIPATING STAGE
FIRST WARNING ISSUED
LAST WARNING ISSUED
NAHA
CHICHI JIMA
IWO JIMA
MARCUS
SAIPAN
GUAM
ULITHI
YAP
PALAU IS
WOLEAI
TRUK
PONAPE
KOSRAE
ENEWETAK
KWAJALEIN
MAJURO
TARAWA
16/00Z
20/06Z
TCFA
ABPW
125°
130°
135°
140°
145°
150°
155°
160°
165°
30°
25°
20°
15°
10°
5°
0°

Tropical Storm Ellis, which formed in the wake of Super Typhoon Dot, proved to be a relatively short-lived system. Although it did not pass close enough to any populated areas to cause significant damage, Ellis was noteworthy since it presented a unique forecasting problem. Originally forecast to move west-northwest under the subtropical ridge and pass relatively close to Guam, it actually slowed just after reaching tropical storm intensity and proceeded to move southwest for almost three days before dissipating over water.

The disturbance which eventually developed into Tropical Storm Ellis was first observed as a curved band of convection near the island of Ponape (WMO 91348) on 14 October. The area was subsequently included on the Significant Tropical Weather Advisory (ABPW PGTW) at 140600Z. The system moved west-northwest and increased in organization during the next 36-hours. At 151730Z, a Tropical Cyclone Formation Alert (TCFA) was issued and aircraft reconnaissance requested for the following day.

Interpretation of the 160000Z visual satellite imagery, using the Dvorak intensity technique, yielded a surface wind estimate of 35 kt (18 m/s). This, in combination with aircraft reconnaissance which located a surface circulation with 35 kt (18 m/s) at the 1500 ft (457 m) level at 160458Z, prompted the first warning on Tropical Storm Ellis at 160500Z. Ellis was forecast to move west-northwest under the subtropical ridge which was apparently well established to the north of the system. At 170000Z Ellis slowed to 3 kt (6 km/hr) as the steering flow south of the subtropical ridge axis weakened in response to the passage of a mid-latitude trough to the north. The forecast philosophy of continuing the west-northwest track was not changed at this point, as a resumption of that movement was expected when the mid-latitude trough moved northeastward. In addition, the synoptic guidance appeared to be in agreement with this reasoning. Figure 3-22-1 is Fleet Numerical Oceanography Center's (FNOC) 700 mb Numerical Variational Analysis (NVA) field for 170000Z, which indicates the weak easterly flow around the subtropical ridge and the mid-latitude trough north of Ellis. The 400 mb analysis for the same time (Figure 3-22-2) indicates similar features, except the north-south extent of the subtropical ridge is much smaller. Note that the flow near Ellis is generally weak and southerly, with weak easterlies to the north.

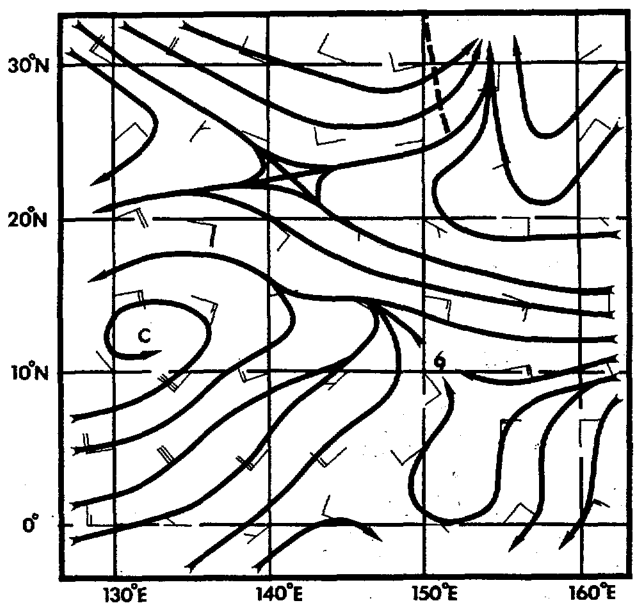

Figure 3-22-1. 170000Z 700 mb Numerical Variational Analyses (NVA) showing weak troughing and 15 kt (8 m/s) easterlies to the north of Ellis.

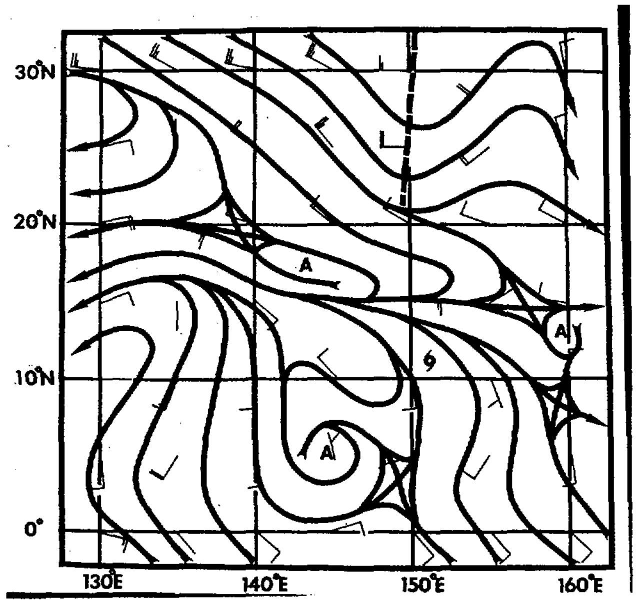

Figure 3-22-2. 170000Z 400 mb NVA depicting weak ridging north of Ellis.

Due to the uncertainity of these mid-tropospheric analyses, synoptic track aircraft missions were requested. The one flown between 0300Z and 0700Z on 17 October provided 400 mb winds in the vicinity of Ellis' forecast track. Figure 3-22-3 shows these observations. In contrast to the NVA analysis (Figure 3-22-2) for that time, the flow is generally northerly to the north and west of Ellis. The lack of data over water in the western North Pacific was probably responsible for the disagreement between the aircraft observations and the NVA analysis at 400 mb. However, the NVA from the following day (180000Z) represented a significant change; the observations from the synoptic track were in good agreement with the new analysis at 400 mb (see Figure 3-22-4).

In the meantime aircraft reconnaissance at

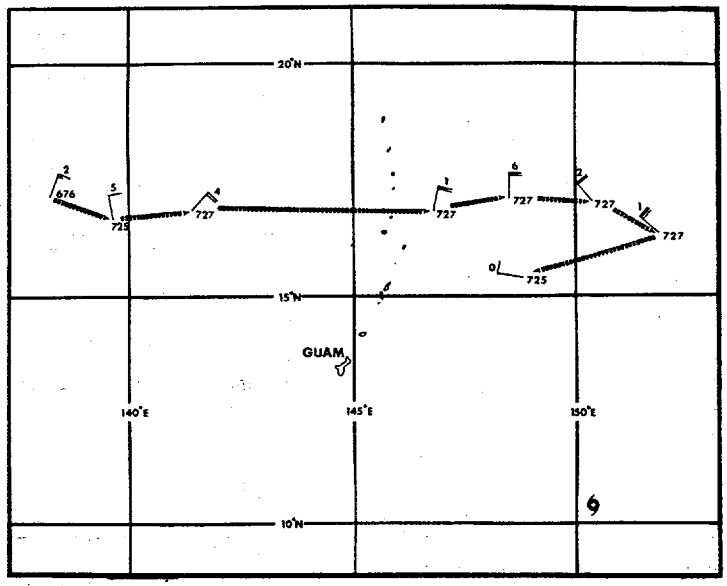

Figure 3-22-3. Observations from the aircraft reconnaissance mission synoptic track at 400 mb, indicating northerly flow vice easterly flow ahead of Ellis.

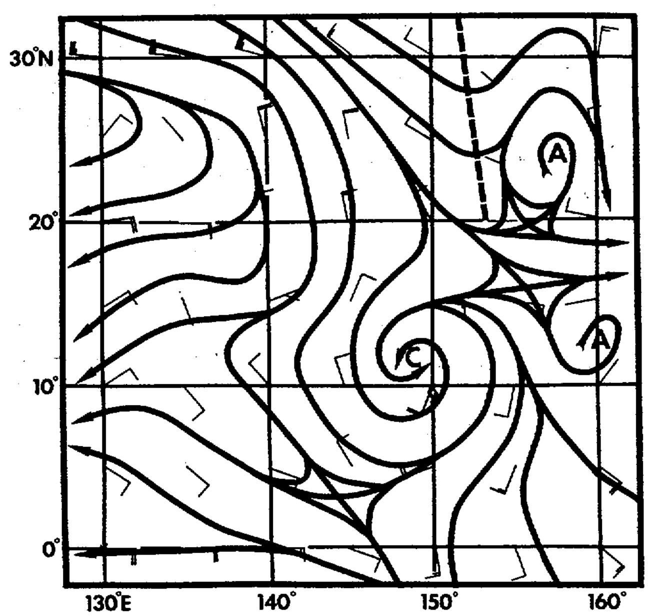

Figure 3-22-4. 180000Z October 400 mb analysis, showing northerly flow ahead of Ellis, which agrees with earlier observations from the synoptic track.

172200Z and 172345Z found the low-level circulation center well south of the forecast track, indicating Ellis had moved south-southwest during the period. At that time Ellis also reached its maximum intensity of 50 kt (26 m/s). The feature that helped to drive the low- to mid-level ridging to the west and moved Ellis to the south-southwest, was most probably an upper cold low, or cell, in the tropical upper-tropospheric trough (TUTT). The 200 mb analysis for 190000Z (see Figure 5-22-5) indicated that the TUTT cell was in close proximity to Ellis. Satellite imagery at that time indicated that upper-level outflow was suppressed in the west semicircle (see Figure 3-22-7). The low- to mid-level flow remained northerly, and Ellis continued its southwestward track.

At 191200Z, Ellis began to weaken as it attempted to move under the TUTT cell and experienced increased vertical shear. By 200000Z the intensity had decreased to 30 kt (15 m/s) and the low-level cloud lines had lost most of their curvature. The last warning was issued at 200600Z.

In retrospect the One-way Tropical Cyclone Model (OTCM) presented a puzzle during the initial forecasts on Ellis, because of its previous performance on Super Typhoon Dot several days before. With Dot, which also formed in low latitudes, OTCM guidance repeatedly, and erroneously, drove the system equa-

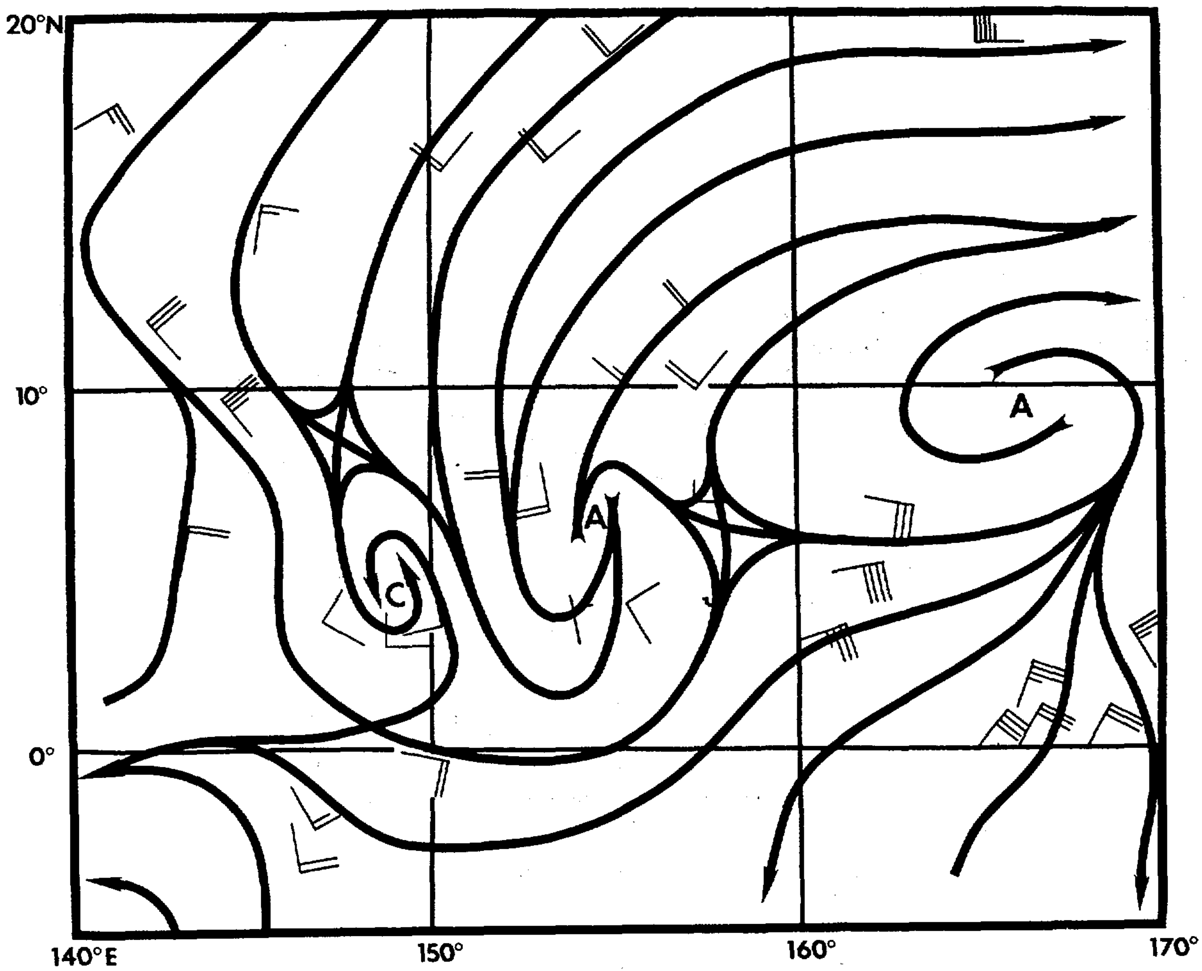

Figure 3-22-5. 190000Z October 200 mb analysis depicting the location of the TUTT and the upper-level cold low.

toward. As a consequence, the OTCM (Figure 3-22-6), which indicated southwest movement for Ellis, was highly suspect. Persistence and climatology favored a west to northwest track through the southern Mariana Islands. As it turned out, Ellis moved southwest, passing well south of the island of Guam. In this case the OTCM guidance was "right" for the "wrong" reasons. After-the-fact it was determined by the software managers at Fleet Numerical Oceanography Center that during this time the Primitive Equation (PE) model was run instead of the Navy Operational Global Atmospheric Prediction System (NOGAPS). Since the PE model was hemispheric - not global - OTCM, when it received the data fields, only found the northern hemisphere with a boundary at the equator. Thus, for a low latitude systems like Ellis and Dot, OTCM generated a spurious vortex due to the lack of southern hemisphere fields. This caused the forecast guidance to fluctuate wildly and drive the system towards the equator. OTCM, subsequently, was modified to incorporate the latest southern hemisphere fields before running.

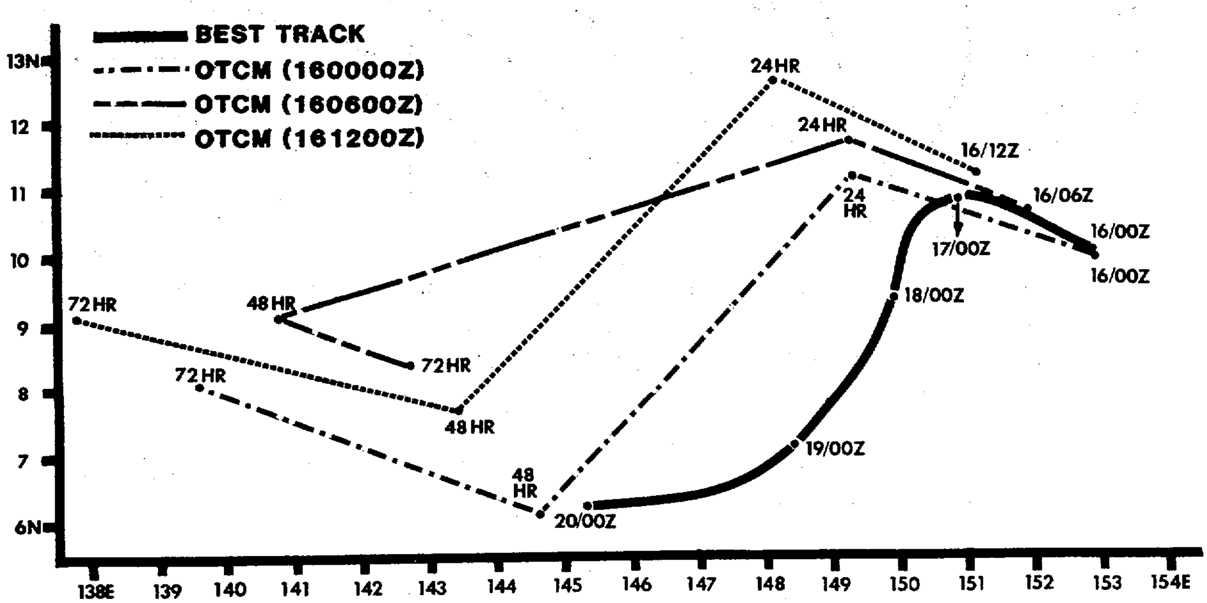

Figure 3-22-6. Comparison of the best track for Ellis with OTCM guidance for the period 160000Z through 161200Z October.

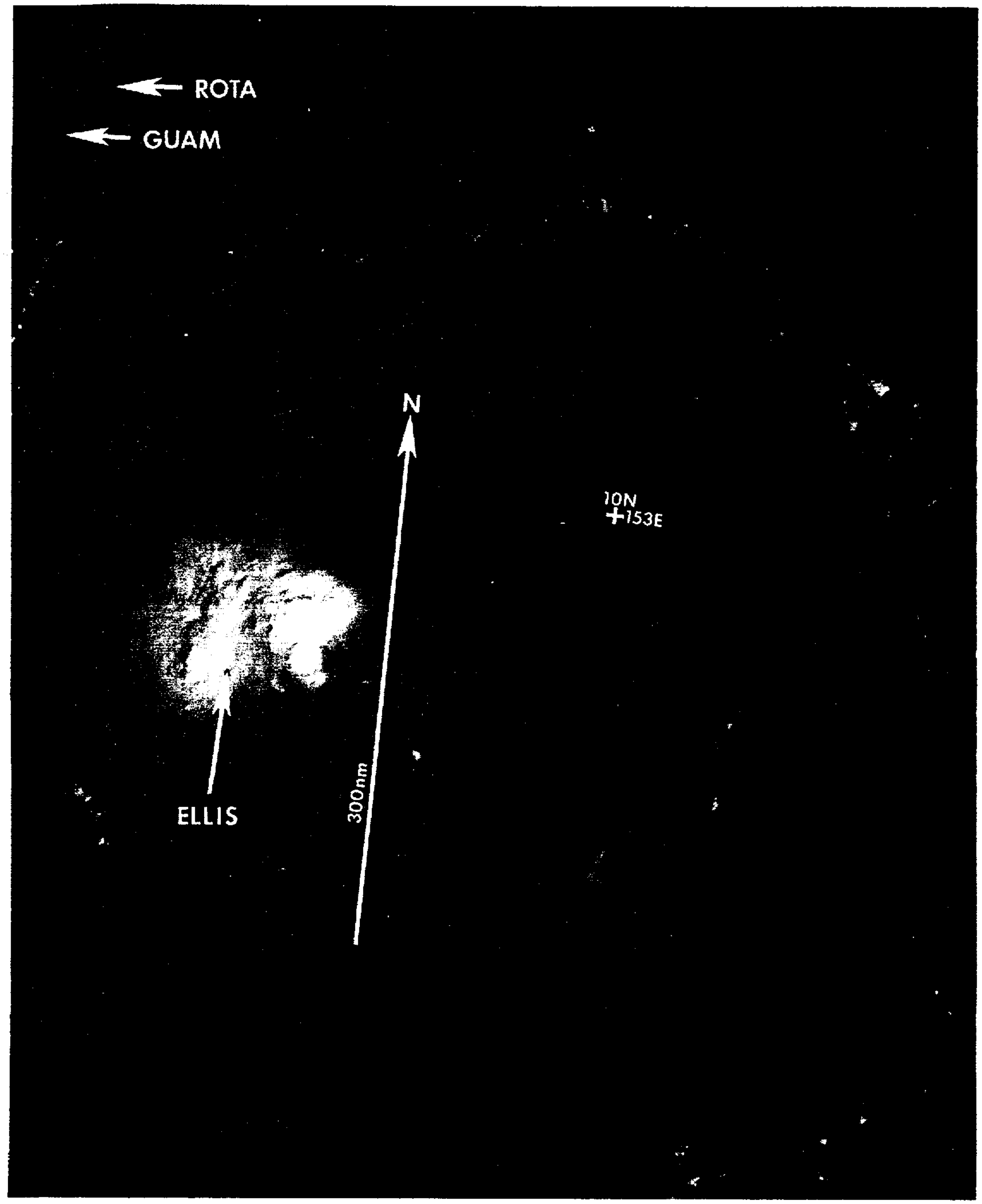

Figure 3-22-7. Tropical Storm Ellis 440 nm (815 km) south-southeast of Guam. Cirrus clouds define the outflow boundary in the eastern semicircle. Although Ellis is near the edge of the satellite imagery, the absence of cirrus in the western semicircle hints at the restricted outflow aloft due to the close proximity of the upper cold low further to the west (182325Z October DMSP visual imagery).